

## PATENT ABSTRACTS OF JAPAN

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## (54) REMOVAL OF MUTAGENIC SUBSTANCE

## (57)Abstract:

PURPOSE: To selectively and effectively remove a mutagenic substance by passing an aq. soln. containing the mutagenic substance through a membrane filter having a compound substance of deoxyribonucleic acid and alginic acid fixed thereon.

CONSTITUTION: An aq. soln. containing a mutagenic substance is passed through a membrane filter having a compound substance of deoxyribonucleic acid (DNA) and alginic acid fixed thereon and the mutagenic substance is adsorbed by the filter to be removed from the aq. soln. Herein, the membrane filter is composed of cellulose nitrate, cellulose acetate or a mixture of them and the mutagenic substance is selected from benzopyrene, an acridine dye and ethidium bromide. The liquid passing method at this time may be performed by a usual means such as natural filtering, vacuum filtering or pressure filtering.

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## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the removal approach of mutagen.

[0002]

[Description of the Prior Art] Mutagen is a chemical which makes mutation induce at a rate higher than the mutation which it is also called mutagen and is automatically generated for a living thing. Since this mutagen has many things used as the so-called carcinogen, after fully being made and defanging, it is necessary to discharge processing of the waste fluid containing them. However, the present condition is that there is no approach suitable as an art of the waste fluid which contains these harmful mutagen conventionally, and technique, such as incineration, is taken.

[0003]

[Problem(s) to be Solved by the Invention] This invention makes it a technical problem to offer the approach of removing alternatively the mutagen which can be carried out advantageously industrially effectively, in view of this present condition.

[0004]

[Means for Solving the Problem] Then, in order to solve the above-mentioned technical problem, as a result of repeating examination for the approach of removing mutagen effectively alternatively, wholeheartedly, this invention persons find out the approach of moreover removing mutagen specifically by the very easy approach, and complete invention.

[0005] That is, this invention offers the approach of making mutagen sticking to this filter and removing mutagen from a water solution alternatively and efficiently, by letting the water solution which contains mutagen in the membrane filter (it abbreviates to a filter hereafter) which made the complex of a deoxyribonucleic acid (it abbreviates to DNA hereafter), and an alginic acid fix pass.

[0006] The mutagen in this invention is harmful matter which has DNA and compatibility, for example, acridine dye such as benzopyrenes, such as benzo[a]pyrene, a benzo [e] pyrene, benzo[a]pyrene -4, 5-oxide, and benzo[a]pyrene 7 oar, an acridine orange, acridine yellow, atebirin, a tripaflavin, Rivanol, and proflavine, an ethidium bromide, actinomycin-D, bis-imide H33258 (alias name HOECHST 33258), etc. are mentioned.

[0007] Hereafter, this invention is described in detail. Although only the complex of the DNA and the alginic acid which were fixed has the removal capacity of mutagen, since the mechanical strength is weak, the thing which made the filter fix the complex of DNA and an alginic acid is used by this invention for reinforcement. Preparation of a filter (it abbreviates to the fixed filter of a DNA-alginic acid hereafter) which made the complex of DNA and an alginic acid fix can be performed by considering the fixed approach of DNA indicated on the Japanese-Patent-Application-No. N 205606 [ five to ] specifications for which it applied previously as reference.

[0008] That is, or it makes a filter immersed in the mixed water solution of the alkali-metal salt of DNA, such as DN sodium, and the alkali-metal salt of alginic acids, such as sodium alginate, and this mixed solution is dropped at a filter front face, after applying this mixed solution on the surface of a filter by applying using Spa Zillah etc., the fixed filter of a DNA-alginic acid can be prepared by making DNA and an alginic acid solidify with divalent metal content compounds, such as a calcium chloride. The thing of the gestalt which the transparent thin film fixed on the surface of the filter by this is obtained. If DNA on a filter and the coagulation of an alginic acid advance easily under a room temperature and there are as long as about 2 to 3 hours, they are enough.

[0009] Since the capacity which adsorbs mutagen becomes large, so that there are many amounts of DNA fixed to the filter, and DNA is stably held so that solidified DNA has good contact nature with a filter, as for the filter used by the invention, what is a hydrophilic property is suitable, and has the structure of a cellulose is the most desirable.

What specifically has the structure of the mixture of the hydrophilic-property-ized polytetrafluoroethylene, the hydrophilic-property-ized polyvinylidene fluoride, bisphenol-poly cull BONETO, a cellulose nitrate, cellulose acetate, a cellulose nitrate, and cellulose acetate is mentioned. In it, the mixture of the cellulose nitrate, the cellulose acetate, cellulose nitrate, and cellulose acetate which have the structure of a cellulose is the optimal.

[0010] With hydrophobic filters, such as a polytetrafluoroethylene (it abbreviates to PTFE hereafter) mold, and a polyvinylidene fluoride mold, since immobilization of DNA and an alginic acid is difficult, it becomes a hydrophobic filter fixable [DNA and an alginic acid] before fixed processing of DNA and an alginic acid in this case by what hydrophilic-property-ization is processed for (what processed hydrophilic-property-ization to PTFE is henceforth called a hydrophilic property PTFE in addition). The filters with the large amount of immobilization of DNA are a cellulose nitrate mold, a cellulose acetate mold, and the mixture mold of a cellulose nitrate and cellulose acetate. In addition, what is necessary is not to restrict especially the aperture of a filter and just to determine it suitably, although the pass time of the solution to a filter becomes late, and the pass time of a solution will generally become quick if an aperture is large so that the aperture of a filter is small.

[0011] By dipping the water solution containing mutagen in the fixed filter of a DNA-alginic acid, mutagen can be made to be able to stick to a filter and mutagen can be alternatively removed from a water solution effectively. What is necessary is for the usual means, such as natural filtration, filtration under reduced pressure, and pressure filtration, to perform the dipping approach at this time.

[0012]

[Example] Next, an example explains this invention further.

[0013] example 1 <fixed of complex of DNA [to various filters], and alginic acid> DNA sodium 109mg (the product made from you KIFAINZU --) double helix structure -- having -- 132.5mg (produced by company --) of sodium alginate. It was washed with water after being immersed in the mixed water solution of DNA and an alginic acid which dissolved in 40ml of water and obtained 4-LVG at the room temperature for about 1 hour and making it solidify the various filters hung up over Table 1 in 10% calcium chloride water solution for about 2 hours until DNA stopped eluting. Then, the complex of DNA and an alginic acid was fixed to various filters by being air-dry.

Measurement of the amount of DNA fixed to the filter was performed by measuring a 260nm ultraviolet absorption spectrum, after dissolving the complex of DNA and an alginic acid using a 0.1-N sodium-hydroxide solution. A result is shown in Table 1. In a filter, the amount of immobilization of DNA to the filter which has cellulose structure is the largest.

[0014]

[Table 1]

表 1

フィルター	硝酸セルロースと酢酸セルロースの混合物型	ビスフェノール-ポリカルボネート型	親水性PTFE型	PTFE型	親水性ポリフッ化ビニリデン型
孔径 ( $\mu\text{m}$ )	0.45	0.2	0.45	0.5	0.45
直径 (mm)	47	47	47	47	47
DNAの固定化量 ( $\mu\text{g}$ )	480.5	69.0	78.2	—	74.2

[0015] The immobilization to the cellulose mold filter of the complex of Example <immobilization of the complex of DNA to a cellulose mold filter, and an alginic acid> 2 DNA, and an alginic acid the mixed water solution of DNA and an alginic acid which dissolved in 10ml of water and obtained DNA sodium 163mg and 199mg of sodium alginate --

filter (the Nihon Millipore make --) By applying to MF membrane (trade name), the mixture mold of a cellulose nitrate and cellulose acetate, and both sides with a diameter of 25mm by Spa Zillah, and washing and being air-dry with water after placing for about 2 to 3 hours and making it solidify in 10% calcium chloride water solution. The filter fixed in the range whose amount of DNA is 0.6-0.8mg was obtained. Moreover, immobilization of an alginic acid was performed by applying the alginic-acid water solution which dissolved in 5ml of water and obtained 199mg of sodium alginate to this filter, and processing it like the above.

[0016] Since it was easy to exfoliate only by having applied the mixed solution of DNA and an alginic acid to the filter and making it solidify, the immobilization to the hydrophilic PTFE mold filter of the complex of Example 3 <immobilization of the complex of DNA to a hydrophilic PTFE mold filter and an alginic acid> 3 DNA and an alginic acid was made to solidify in the condition of putting the mixed solution of DNA and an alginic acid between the filters of two sheets, and was performed. That is, the filter fixed in the range whose amount of DNA is 0.8-1.0mg was obtained by putting the mixed solution of DNA which dissolved in 5ml of water and obtained DNA sodium 163mg and 199mg of sodium alginate, and an alginic acid between two filters (the Nihon Millipore make, an OMUNI pore membrane (trade name), diameter of 25mm), and washing with water, after placing for about 2 to 3 hours and making it solidify in 10% calcium chloride water solution. Moreover, immobilization of an alginic acid was performed by processing like the above the alginic-acid water solution which dissolved in 5ml of water and obtained 199mg of sodium alginate to this filter.

[0017] It dipped in the cellulose mold filter which prepared example 4 <adsorption of benzopyrene with filter> 1, an the benzopyrene solution of 1.1 micromole which dissolved in 10ml of mixed solvents of a water-acetone-methanol (7:2:1), and obtained 2-benzopyrene (alias name benzo [e] pyrene) 2.77ug in the example 2, and the visible absorption spectrum of the filtrate after dipping was measured. By pressurizing the test solution put in to the syringe, dipping to filter was extruded to the filter and went to it. The result is shown in drawing 1.

[0018] With the filter and unsettled filter which made the alginic acid fix, with the fixed filter of a DNA-alginic acid an absorption peak is not seen at all to the peak of the 386nm benzopyrene origin being put at 365nm, but this filter is perfectly adsorbed in the benzopyrene. On the other hand, 1 of 3.4 micromole and 2-benzopyrene solution are created and the result dipped in the hydrophilic PTFE mold filter prepared in the example 3 is shown in drawing 2. The fixed filter of a DNA-alginic acid is almost adsorbed in a benzopyrene, and it is removed.

[0019] 10ml of ethidium bromide water solutions of example 5 <adsorption of ethidium bromide with filter> 8.3 micromole was created, and adsorption of an ethidium bromide in a filter was measured by the same actuation as an example 4. The result dipped with the cellulose mold filter is shown in drawing 3. It is imperfect, although the inclination for an ethidium bromide to become that a filter is easy to adsorb was seen so that the aperture became small with the unsettled filter. Moreover, although the filter of removal of an ethidium bromide which made only the alginic acid fix is inadequate, with the fixed filter of a DNA-alginic acid, an absorption peak is not looked at at all by 480nm the ethidium bromide origin, but this filter is completely adsorbed in the ethidium bromide. On the other hand, the result dipped with the hydrophilic PTFE mold filter is shown in drawing 4. With the fixed filter of a DNA-alginic acid the ethidium bromide almost adsorbed.

[0020] It created each 10ml of acridine orange water solutions of example 6 <adsorption of acridine orange with filter> 2.3 micromole, and 3.7 micromole, and adsorption of an acridine orange in a filter was measured by the same actuation as an example 4. The result dipped with the cellulose mold filter is shown in drawing 5. The absorption peak of the acridine orange origin was not looked at at all by the filtrate dipped in the fixed filter of a DNA-alginic acid. On the other hand, the result dipped with the filter of a hydrophilic PTFE mold is shown in drawing 6. Although most acridine oranges adsorbed with the fixed filter of a DNA-alginic acid, the absorption peak of an acridine orange was looked at a little by 491nm.

[0021]

[Effect of the Invention] Mutagen is effectively removable easily with this invention.

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CLAIMS

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[Claim(s)]

[Claim 1] The removal approach of the mutagen characterized by making mutagen stick to this membrane filter, and removing mutagen from a water solution by letting the water solution which contains mutagen in the membrane filter which made the complex of a deoxyribonucleic acid and an alginic acid fix pass.

[Claim 2] The removal approach of the mutagen according to claim 1 which is the membrane filter which has the structure where a membrane filter is chosen from the mixture of a cellulose nitrate, cellulose acetate and a cellulose nitrate, and cellulose acetate.

[Claim 3] The removal approach of mutagen according to claim 1 that mutagen is a benzopyrene, acridine dye, and t mutagen chosen from an ethidium bromide.

[Claim 4] The membrane filter which made the complex of a deoxyribonucleic acid and an alginic acid fix.

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